AMENDED CLAIM SET

Claim 1. (Currently Amended)

An optical transmission apparatus for transmitting an optical pulse string having a frequency two times that of a driving signal (fc), said optical transmission apparatus comprising:

a Mach-Zehnder optical modulator;

a light source which inputs an optical signal into said optical modulator;

a driving unit which inputs the driving signal into the optical modulator;

a converting unit which receives a frequency component of the driving signal (fc), takes out a part of an optical signal output from said optical modulator and converts that part of the optical signal into electric signal;

an extracting unit connected to the converting unit, the extracting unit extracting the which extracts a frequency component of the driving signal (fc) included in the electric signal converted by said converting unit;

an error signal generating unit which includes a level detector for detecting a level of the frequency component of the driving signal (fc) and a processing unit for generating an error signal based on the level detected by the level detector, the error signal generating unit generating the generates an error signal of a bias voltage for minimizing a value of a frequency component of the driving signal (fc) extracted by said extracting unit; and

a bias voltage control unit which applies a bias voltage obtained as a result of addition of the bias voltage and a voltage corresponding to the error signal to said optical modulator, wherein

modulation factor β of the Mach-Zehnder optical modulator is set as $\beta=2\pi$ and initial phase δ of the Mach-Zehnder optical modulator is set as $\delta=0$ for outputting the optical pulse string having a frequency two times that of a driving signal(fc).

Claim 2. (Original)

The optical transmission apparatus according to claim 1, wherein

said light source generates a modulated optical pulse synchronous with the driving signal and having a bit rate two times that of the driving signal, and supplies the optical pulse to said optical modulator, and

said optical modulator pulse modulates the optical pulse with the driving signal and outputs the modulated optical pulse.

Claim 3. (Original)

The optical transmission apparatus according to claim 1, wherein said light source includes a plurality of single-wavelength light sources each of which emits light having different single-wavelength,

said optical transmission apparatus further comprising an optical filter, provided at the front stage of said converting unit, which transmits light having only a desired wavelength out of the lights having different wavelength emitted by said single-wavelength light sources that constitute an optical signal output from said optical modulator.

Claim 4. (Original)

The optical transmission apparatus according to claim 1 further comprising a dither signal generating unit which generates a dither signal that is input into the error signal generating unit and the bias voltage control unit, wherein

said error signal generating unit carries out a synchronous detection by multiplying a dither signal to a frequency component of a driving signal or a frequency component two times that of the driving signal extracted by said extracting unit, and outputs a result of this synchronous detection to the bias voltage control unit as an error signal of the bias voltage, and

said bias voltage control unit applies to said optical modulator a signal obtained by superimposing the error signal of the bias voltage with the bias voltage and the dither signal.

Claim 5. (Currently Amended)

An optical transmission apparatus for transmitting an optical pulse string having a frequency two times that of a driving signal (fc), said optical transmission apparatus comprising:

a Mach-Zehnder optical modulator;

a light source which inputs an optical signal into said optical modulator;

a driving unit which inputs the driving signal into said optical modulator;

a converting unit which receives a frequency component of the driving signal (fc), takes out a part of an optical signal output from said optical modulator and converts that part of the optical signal into electric signal;

an extracting unit which connected to the converting unit, the extracting unit extracting the extracts a frequency component two times that of the driving signal (fc) included in the electric signal converted by said converting unit;

an error signal generating unit which includes a level detector for detecting a level of the frequency component of the driving signal (fc) and a processing unit for generating an error signal based on the level detected by the level detector, the error signal generating unit generating the generates an error signal of a bias voltage for maximizing a value of the frequency component two times that of the driving signal (fc) extracted by said extracting unit; and

a bias voltage control unit which applies a bias voltage added with an error signal of the bias voltage to said optical modulator, wherein

modulation factor β of the Mach-Zehnder optical modulator is set as $\beta=2\pi$ and initial phase δ of the Mach-Zehnder optical modulator is set as $\delta=0$ for outputting the optical pulse string having a frequency two times that of a driving signal(fc).

Claim 6. (Original)

The optical transmission apparatus according to claim 5, wherein

said light source generates a modulated optical pulse synchronous with the driving signal and having a bit rate two times that of the driving signal, and supplies the optical pulse to said optical modulator, and

said optical modulator pulse modulates the optical pulse with the driving signal and outputs the modulated optical pulse.

Claim 7. (Original)

The optical transmission apparatus according to claim 5, wherein said light source includes a plurality of single-wavelength light sources each of which emits light having different single-wavelength,

said optical transmission apparatus further comprising an optical filter, provided at the front stage of said converting unit, which transmits light having only a desired wavelength out of the lights having different wavelength emitted by said single-wavelength light sources that constitute an optical signal output from said optical modulator.

Claim 8. (Original)

The optical transmission apparatus according to claim 5 further comprising a dither signal generating unit which generates a dither signal that is input into the error signal generating unit and the bias voltage control unit, wherein

said error signal generating unit carries out a synchronous detection by multiplying a dither signal to a frequency component of a driving signal or a frequency component two times that of the driving signal extracted by said

extracting unit, and outputs a result of this synchronous detection to the bias voltage control unit as an error signal of the bias voltage, and

said bias voltage control unit applies to said optical modulator a signal obtained by superimposing the error signal of the bias voltage with the bias voltage and the dither signal.

Claim 9. (Currently Amended)

A bias voltage control method for an optical modulator to be used for an optical transmission apparatus that inputs an optical signal into a Mach-Zehnder optical modulator, applies a driving signal and a bias voltage to said optical modulator, and transmits an optical pulse string having a frequency two times that of the driving signal, the method comprising:

receiving a frequency component of the driving signal (fc);

taking out a part of an optical signal output from said optical modulator and converting that part of the optical signal into electric signal;

extracting a frequency component of the driving signal from the obtained electric signal;

detecting a level of the frequency component of the driving signal (fc);

generating an error signal of a bias voltage based on the level detected for minimizing a value of the frequency component of the driving signal; and

applying a bias voltage obtained as a result of addition of the bias voltage and a voltage corresponding to the error signal to said optical modulator, wherein

modulation factor β of the Mach-Zehnder optical modulator is set as $\beta=2\pi$ and initial phase δ of the Mach-Zehnder optical modulator is set as $\delta=0$ for outputting the optical pulse string having a frequency two times that of a driving signal(fc).

Claim 10. (Currently Amended)

A bias voltage control method for an optical modulator to be used for an optical transmission apparatus that inputs an optical signal into a Mach-Zehnder optical modulator,

applies a driving signal and a bias voltage to said optical modulator, and transmits an optical pulse string having a frequency two times that of the driving signal, the method comprising:

receiving a frequency component of the driving signal (fc);

taking out a part of an optical signal output from said optical modulator and converting that part of the optical signal into electric signal;

extracting a frequency component two times that of the driving signal from the obtained electric signal;

detecting a level of the frequency component of the driving signal (fc);

generating an error signal of a bias voltage based on the level detected for maximizing a value of the frequency component two times that of the driving signal; and

applying a bias voltage, added with a voltage corresponding to the error signal, to said optical modulator , wherein

modulation factor β of the Mach-Zehnder optical modulator is set as $\beta=2\pi$ and initial phase δ of the Mach-Zehnder optical modulator is set as $\delta=0$ for outputting the optical pulse string having a frequency two times that of a driving signal(fc).

Claim 11. (Currently Amended)

A method of making an optical transmission apparatus, comprising:

providing an optical modulator to output an optical signal;

providing a first signal generator to generate a driving signal for said optical modulator, said driving signal including a frequency component; and

providing a second signal generator to generate an error signal, the second signal generator including a level detector for detecting a level of the frequency component and a processor for generating an error signal based on the level detected by the level detector, said error signal being generated from the frequency component satisfying a predetermined threshold to generate a digital detection signal which is converted to an analog signal indicating a change in a bias voltage to be input to said optical modulator;

providing a controller to generate the bias voltage, said bias voltage being generated from combining said error signal with a predetermined bias voltage;

wherein said bias voltage and said driving signal being input to drive the optical modulator, wherein

modulation factor β of the Mach-Zehnder optical modulator is set as $\beta=2\pi$ and initial phase δ of the Mach-Zehnder optical modulator is set as $\delta=0$ for outputting the optical pulse string having a frequency two times that of a driving signal(fc) .

Claim 12. (Previously Presented)

The method of claim 11, wherein said providing an optical modulator includes providing the optical modulator to output an optical signal with a frequency two times greater than value of frequency component of the driving signal.

Claim 13. (Previously Presented)

The method of claim 11, wherein said providing a second signal generator includes providing the second signal generator to generate an error signal to minimize the value of the frequency component of the driving signal.

Claim 14. (Previously Presented)

The method of claim 11, wherein said providing a second signal generator includes providing the second signal generator to generate an error signal to maximize the value of two times said frequency component of the driving signal.